Table 2.1. Water quality and biological community sampling parameters, sampling locations, sampling techniques, and analysis techniques. "BF" = baseflow and "SF" = stormflow. "EPA Method" refers to Methods for Chemical Analysis of Water and Wastes (USEPA 1983) except for PAHs. Grab samples were collected according to standard methods (APHA 1995, section 1060). [1]The maximum holding time for total suspended solids was incorrectly stated as being 48 hours in the quality assurance project plan. An asterisk (*) indicates that NO2 and NO3 measurements were made using the same sample. "HETL" = State of Maine Health and Environmental Testing Laboratory.

Parameter	Parameter Subgroup	Flow Conditions	Sampling Technique	Sample Area/Volume	Sample Preservation / Maximum Holding Time	Analysis Technique	Analysis Location
Total Suspended Solids [Q]	--	BF+SF	grab sample	1 L	4°C; 7 days[1]	Method 2540 D (APHA et al. 1995)	HETL
Metals [Q]	lead, cadmium, zinc, copper, nickel	BF+SF	grab sample	1 L	Acidify (HNO_3) + 4°C; 6 months	EPA Method 200.7	HETL
Metal [Q]	Mercury	BF+SF	grab sample	1 L	Acidify (HNO_3) + 4°C; 28 days	EPA Method 245.1	HETL
Nitrogen [Q]	TKN	BF+SF	grab sample	250 ml	Acidify (H_2SO_4) + 4°C; 28 days	EPA Method 351.2	HETL
Nitrogen [Q]	NO_2	BF+SF	grab sample	250 ml*	4°C; 48 hr	EPA Method 353.2	HETL
Nitrogen [Q]	NO_3	BF+SF	grab sample	250 ml*	4°C; 48 hr	EPA Method 353.2	HETL
Phosphorous [Q]	Total-P	BF+SF	grab sample	55 ml	4°C; 28 days	EPA Method 365.1	HETL
Phosphorous [Q]	Ortho-P	BF+SF	grab sample	250 ml	4°C; 48 hr	EPA Method 365.1	HETL
Chloride [Q]	--	BF+SF	grab sample	250 ml	4°C; 28 days	EPA Method 325.2	HETL
Oil and Grease [Q]	--	BF+SF	grab sample	1 L	Acidify (H_2SO_4) + 4°C; 28 days	EPA Method 1664 (Hexane extractable) (recently promulgated method)	Katahdin Analytical
Temperature [Q]	--	continuous monitoring	Onset Stowaway data logger (model WTA-5 37)	--	--	download onto computer using BoxCar v.3.51	field
pH [Q]	--	BF	Orion field meter (model 290A)	--	--	field	field
Dissolved Oxygen [Q]	--	BF	YSI field meter (model 85)	--	--	field	field
Conductivity [Q]	--	BF	YSI field meter (model 85)	--	--	field	field
PAHs [Q]	--	SF	grab sample	1 L; 1 Gallon	4°C; 7 days	EPA method for PAHs	EPA Lab - Region 1
E. coli bacteria [NQ]	--	BF+SF	grab sample	1 L	4°C; 6 hr	Method 9213 D (APHA et al. 1995)	DEP-Portland
Periphyton: Chlorophyll-*a* [NQ]	--	BF	scrape artificial substrates (Stevenson and Bahls 1999)	25.12 cm^2	Buffer w/ MgCO3 and filter within 24 hrs; keep in foil in freezer until analysis; 21 day holding time	(Stevenson and Bahls 1999)	HETL
Periphyton: Species Composition [NQ]	--	BF	multihabitat sampling (Stevenson and Bahls 1999)	730 cm^2	M3 (Stevenson and Bahls 1999)	(Stevenson and Bahls 1999)	Michigan State University (Dr. Jan Stevenson)
Macroinvertebrates: Abundance & Species Composition [NQ]	rockbags	BF	artificial substrate (rockbag) sampling (Davies and Tsomides 1997)	7.25 kg of small cobbles	70% Ethyl Alcohol	(Davies and Tsomides 1997)	field; MDEP lab; Lotic, Inc.
Macroinvertebrates: Abundance & Species Composition [NQ]	multihabitat	BF	multihabitat sampling with D-net (USEPA 1999)	~ 2.36 m^2	70% Ethyl Alcohol	(USEPA 1999)	field; MDEP lab; Lotic, Inc.
Fish: Abundance & Species Composition [Q]	--	BF	electrofishing (USEPA 1999)	200-m reach	70% Ethyl Alcohol for voucher specimens	(USEPA 1999)	field

Table 2.2. Macroinvertebrate sampling techniques for specific habitat types.

Habitat Type	Sampling Technique
Sand / Clay	Bump and jab the dip net (0.5 m) through the soft substrates.
Snags (not recent deadfall)	Hold net downstream when collecting wood; scrape an area about the size of 10 fists (~630 cm^2) of woody debris to collect macroinvertebrates
Submerged Areas Of Undercut Banks	Jab dip net 0.5 m into area of protruding roots and plant material; with the net in place, the area is kicked first.
Submerged Macrophytes	Bump along bottom or jab dip net 0.5 m through macrophyte bed.
Cobble / Gravel	Kick 0.5 m upstream of dip net.
Leaf Packs	Kick 0.5 m upstream of dip net.

Table 3.1.1. Long Creek and Red Brook study site codes, locations, and types. [1]Much of the lower half of LC-M stream mileage labeling is estimated because the GPS points don't match the topo stream lines (probably because this area was filled in and the stream was either pushed over or it migrated). * For the purposes of this comparative study. ** Long Creek = add 1.81 miles to go from bottom of "flowing" (top of Clark's Pond impounded water for LC) section downstream to the junction w/ the Fore River. ** Red Brook = add 0.29 miles to go from bottom of "flowing" section of Red Brook to junction w/ Long Creek (inside Clark's Pond). Distance from top of Clark's Pond

confluence of the Goodyear and Sable Oakes tribs is 0.656 miles (= total of 2.256 mi). A "typical" habitat study site was one dominated both by pools and glides and sands and silts, and also was meandering and forested, although disturbed may have existed either upstream or downstream of the site.

Stream Segment	Stream Mile*	Name	Habitat Type	Approx-imate Mileage ?	True Stream Mile**	Notes
LC-M-	0.380	V-Tec RW	typical	y[1]		rockbag
LC-M-	0.432	*V-Tec RW*		y[1]		cross-section
LC-M-	0.533	Cobbles below Dunkin Donuts	riffle below rd	y[1]		multihabitat inverts
LC-M-	0.595	Discharge site - Mall Plaza trib		y[1]		approximately 0.02 miles above the periphyton site
LC-M-	0.603	Foden Rd RW	above rd culvert	y[1]		cross-section
LC-M-	0.870	Big Storm Drain Outlet Adjacent To LC-Main Trib (near Service Merchandise)				
LC-M-	0.910	Service Merchandise -upstream of storm pond outlet	typical			rockbag
LC-M-	1.517	Public Works	typical			periphyton
LC-M-	1.653	Public Works				cross-section
LC-M-	2.191	Confluence below Goodyr	riffle	y		multihabitat inverts & temperature
LC-M-	2.270	Sable Oaks	typical	y		rockbag
LC-M-	2.754	Main trib - near Spring St; below RWS		y		baseflow wq monitoring station
LC-M-	2.875	In-stream detention basin; small dam		y		Dam location at bottom of basin; lots of emergent macrophytes in basin
LC-M-	3.098	wetland area near Jordan's Meats / Gannett News	typical			Habitat evaluation site
LC-M-	not a GPS point	Foden Rd RW	above rd culvert	y		periphyton site -- approximately 0.02 miles downstream from the Q site

Table 3.1.1. cont'd.

Stream Segment	Stream Mile*	Name	Habitat Type	Approx-imate Mileage ?	True Stream Mile**	Notes
LC-Mn-	2.274	Goodyear	typical	y		rockbag
LC-Mn-	2.714	Trapper Brown / Glassworld / Cummings Rd	above rd culvert	y		periphyton
LC-Mn-	3.224	forest below proposed waste transfer station in Westbrook	forest, steeper	very rough		
LC-Mw-	2.896	Main-trib below landfill	typical			multihabitat inverts
LC-N	0.404	*V-Tec LW*	*typical*			cross-section
LC-N	0.415	V-Tec LW	typical			rockbag
LC-N-	0.585	Foden Rd LW	above rd culvert			
LC-N-	0.585	Discharge site - Jetport trib				
LC-N-	0.595	Foden Rd LW	above rd culvert			cross-section
LC-S-	0.016	Below HQ				temperature site below Home Depot (HQ)
LC-S-	0.053	MM-trib above C. Pond	typical			multihabitat inverts
LC-S-	0.186	Discharge site - Maine Mall trib (near MVP Sports)				
LC-S-	0.220	(Hoyts) Maine Mall trib near MVP Sports	typical			Cross-section ~50 m upstream from Q site
LC-S-	0.254	Hoyts (above upper culvert)	above rd culvert			periphyton
LC-S-	0.369	Hoyts	typical			rockbag
LC-S-	0.476	Big Storm Drain Outlet Adjacent To LC-Maine Mall trib (channelized reach)				
LC-S-	0.496	MM-trib above detent. pond	cattail veg.	y		
RB	0.071	HQ	typical			rockbag
RB	1.434	*La-z-boy*				cross-section
RB	1.474	La-z-boy	typical			rockbag
RB	1.694	Discharge site - near Fairfield Inn				
RB	2.119	Lions Club	typical			cross-section
RB	2.790	New Rd (above)	above rd culvert			periphyton
RB	3.961	RWS	typical			rockbag

Table 3.1.2. Study site watershed and subwatershed size and percent total impervious area information. These numbers were obtained from USGS topographic maps and 1995 photographs.

Stream Code	Stream Mile	Site	Immediate Subwatershed Area (acres)	Cumulative Subwatershed Area (acres) [includes upstream subwatersheds]	----------IMPERVIOUS SURFACES (acres)---------- Residential Areas	Industrial / Commercial / Parking Areas	Roads	Total Impervious Area	Cumulative Total Impervious Area	Immediate subwatershed TOTAL PERCENT IMPERVIOUS AREA (acres)	Cumulative (immediate + upstream) subwatersheds TOTAL PERCENT IMPERVIOUS AREA (acres)
Red Brook											
RB-	3.961	Above RWS	508.00	508.00	3.04	0.00	7.49	10.53	10.53	2.1	**2.1**
RB-	1.694	Fairfield Inn - Q site	841.10	1349.10	7.50	3.80	58.34	69.64	80.16	8.3	**5.9**
RB-	1.474	Lazyboy	98.40	1447.50	0.00	23.00	11.54	34.54	114.70	35.1	**7.9**
RB-	0.071	HQ	339.10	1786.60	0.50	33.60	20.84	54.94	169.64	16.2	**9.5**
Long Creek - Maine Mall Tributary											
LC-S-	0.369	Hoyts	361.00	361.00	0.00	147.30	16.74	164.04	164.04	45.4	**45.4**
LC-S-	0.186	Maine Mall - Q site	27.70	388.70	0.00	18.60	0.00	18.60	182.64	67.1	**47.0**
Long Creek - Main Tributary											
LC-Mn-	3.224 ~	Westbrook Transfer Station	98.50	98.50	0.00	3.30	1.05	4.35	4.35	4.4	**4.4**
LC-Mn-	2.274 ~	Goodyear	328.70	427.20	2.26	43.90	10.39	56.55	60.90	17.2	**14.3**
LC-M-	2.270 ~	Sable Oakes	670.40	670.40	0.79	32.43	14.10	47.32	47.32	7.1	**7.1**
		Goodyear + Sable Oakes		*1097.60*					*108.22*		***9.9***
LC-M-	1.653	Public Works	123.00	1220.60	0.00	8.30	0.55	8.85	117.08	7.2	**9.6**
LC-M-	0.910	Service Merch.	159.50	1380.10	0.00	17.80	4.94	22.74	139.82	14.3	**10.1**
LC-M-	0.595	Mall Plaza - Q site - Foden Rd	69.60	1449.70	0.00	43.00	3.48	46.48	186.30	66.8	**12.9**
LC-M-	0.380	VTEC-RW	21.20	1470.90	0.00	8.20	3.95	12.15	198.45	57.3	**13.5**
Long Creek - Jetport Tributary					V includes airstrip V						
LC-N-	0.585	Jetport - Q site - Foden Rd	246.70	246.70	0.00	70.50	9.52	80.02	80.02	32.4	**32.4**
LC-N-	0.415	VTEC - LW	15.30	262.00	0.00	5.10	0.35	5.45	85.47	35.6	**32.6**

Table 3.2.1. Associations observed when community metrics from the rockbag macroinvertebrate data were plotted against the percent total impervious area (PTIA) values for the subwatersheds above each of the sampling sites (Figs. 3.2.5a-e). Letters (a-e) in parentheses refer to the particular figure being discussed. The letters "nct" indicate that no clear trend was apparent. (Note: Although some trends were observed in the data, it is important to recognize the relatively small number of sites in the plots, especially when examining within-stream trends.)

Community Metric	Associations Found When Examining All Sites ?	Associations Observed Between Red Brook (RB) and PTIA ?	Associations Observed Between Long Creek mainstem (LC-M) and PTIA ?
Statutory Class (a)	Above PTIA of 15 %, all sites were Class C.	nct	nct
Model Outcome; Prob. Class B or Better; Prob. Class A or Better (a)	The only site having a model outcome better than "C" was RB-3.961	nct	nct
Total Abundance (b)	nct	nct	Total abundance decreased as PTIA increased.
Generic Richness (b)	nct	Generic richness decreased as PTIA increased.	
Ephemeroptera Abundance (b)	nct	nct	Ephmeroptera abundance decreased as PTIA increased.
Plecoptera Abundance (b)	The only site which had stoneflies was RB-3.961, the site which had the lowest PTIA.	nct	nct
Shannon-Weiner Diversity (b)	nct	Decreased as PTIA increased.	nct
Hilsenhoff Biotic Index (b)	Above PTIA of 15% all HBI values were > 6.	nct	nct
Relative Abundance Chironomidae (c)	nct	Decreased as PTIA increased.	Increased (slightly) as PTIA increased.
Relative Richness of Diptera (c)	nct	Decreased as PTIA increased.	nct
Hydropsyche Abundance (c)	nct	Decreased as PTIA increased.	Increased as PTIA increased.
Cheumatopsyche Abundance (c)	nct	nct	nct
EPT Generic Richness / Diptera Richness (c)	nct	Increased as PTIA increased.	nct
Relative Abundance of Oligochaeta (c)	nct	Decreased as PTIA increased (rough trend).	Decreased as PTIA increased (rough trend).
Perlidae Abundance (d)	nct	nct	nct
Tanypodinae Abundance (d)	nct	nct	nct

Table 3.2.1. cont'd.

Community Metric	Associations Found When Examining All Sites ?	Associations Observed Between Red Brook (RB) and PTIA ?	Associations Observed Between Long Creek mainstem (LC-M) and PTIA ?
Chironomini Abundance (d)	nct	Decreased slightly as PTIA increased.	nct
Relative Abundance Ephmeroptera (d)	nct	Increased as PTIA increased.	nct
EPT Generic Richness (d)	Decreased as PTIA increased (a rough trend).	Decreased as PTIA increased.	nct
Summed Abundance DMPH (d)	Decreased as PTIA increased (a rough trend).	Decreased as PTIA increased.	Decreased as PTIA increased.
Relative Richness Plecoptera (e)	Plecoptera only found at PTIA < 3%.	nct	nct
Summed Abundances AS (e)	Decreased as PTIA increased (a rough trend).	Decreased as PTIA increased.	nct
EP Generic Richness/14 (e)	Decreased as PTIA increased (a rough trend).	nct	nct
Dominant A Taxa/5 (e)	Decreased as PTIA increased (a rough trend).	nct	nct
Presence A Indicator Taxa (e)	Decreased as PTIA increased (a rough trend).	nct	nct

Table 3.2.2. A habitat/ecology assessment of various taxa found in rockbag data for the study streams plus some nearby sandy reference streams.
1= Reference sites for this table included the two upper Red Brook sites plus a number of other sandy, relatively unimpacted streams in southern Maine.
2= This table is primarily insects, except for Amphipoda, which are crustaceans.

Order	Family	Genus (Species)	Ecology	Occurrence In Reference Sandy Streams	Occurrence In Upper Red Brook Site*	Occurrence In Long Creek Sites
Genera associated with sandy southern Maine reference-type streams						
Plecoptera	Leuctridae	*Leuctra*	Variable, many species; lotic erosional-depositional; probable cold-water obligate; feeding charachteristics: detrivore? /unknown	YES - All selected sandy reference streams	YES - RB-above	NO
Trichoptera	Odontoceridae	*Psilotreta*	Lotic erosional and depositional; sprawler, burrower, scraper, collector-gatherer primariliy plant material	YES - Cole Bk.; Branch Bk.; Goosefare Bk.; Eddy Bk.	YES - RB-above	NO
Ephemeroptera	Leptophlebiidae	*Paraleptophlebia debilis* (Cole Bk. Spp.)	Burrower in loosely sorted large fines; collected down to 10 cm *(from Burian)* [clean flushed sands?]	YES - all selected sandy reference streams	YES - RB-above	NO
Diptera	Chironomidae	*Heterotrissocladius*	Associated with ultra-oligotrophic lakes; also occurs in clear streams *(from Wiederholm)*	YES - Goosefare Bk.; Cooks; Eddy	YES - RB-above	NO
Diptera	Chironomidae	*Stempellinella*	Wide range of flows - lotic erosional, lentic littoral	YES - log 797	YES - RB-above	YES - LC- Sable Oaks
Genera associated with Long Creek but not occurring in reference streams[1]						
Amphipoda[2]		*Hyalella & Crangonyx*		NO	NO	logs 849, 850, 851, 852, 854
Ephemeroptera	Caenidae	*Caenis*	Depositional, low velocity in fine organic substrates among rooted macrophytes, "nymphs often covered in organic debris" *(from Burian)*	NO	NO	logs 849, 850, 851, 852, 853, 854, 855, and RB-HQ
Coleoptera	?	*Dubiraphia*	Lentic and lotic on submerged macrophytes			

Other notes

Long Creek-N (VTEC-LW; log 850) --- (*Hyalella* 20%; *Physella* 11%; *Procladius* 15% [prefers muddy substrates]; *Ptilostomis* 7.4%; *Limnephilus* 6% [many spp., wide variety of habitats, drought tolerant diapause stage w/ adaptations for extreme events])

versus

Cole Brook (log 809) --- (Richness = 52; EPT = 19; *Paraleptophlebia debilis* 27%; *Baetis tricaudatis* 15% [most abundant in clumped CPOM, some in poorly sorted gravel and erosional areas of riffles and transitional areas of runs; most in 1st odrer tributaries [from Burian]]; Leuctra 13%)

Table 3.3.1. Concentrations of polycyclic aromatic hydrocarbons (PAHs) at study sites in the Long Creek and Red Brook watersheds during storm events. For each site, these samples were collected as composite samples comprised of three individual grab samples gathered during the first flush period of their respective storms. An astersisk (*) indicates that a field duplicate was not analyzed by the lab for storm 3 even though it was collected in the field and the same container- and data sheet-labeling procedure was used. "J" = The first internal standard was high, therefore the napthalene result is considered to be an estimated value. "nd" = not detected. Note: the author is skeptical of the field blank values for acenaphthene and naphthalene because these compounds were not detected in the storm water samples.

		Date: 10/23/00 - STORM 2								**Date: 9/25/01 - STORM 3**						
			Site								**Site**					
EPA Priority ?	Priority Pollutant **PAH Compounds**	Reporting Limit	**LC-S-0.186**	**LC-N 0.585**	**LC-M 0.595**	**RB 1.694**	**Field Blank**	**DUP LC-N 0.585**	Precision LC-N-0.585 vs. DUP **(RPD)**	Reporting Limit	**LC-S-0.186**	**LC-N 0.585**	**LC-M 0.595**	**RB 1.694**	**Field Blank**	**DUP LC-M 0.595***
3	Acenaphthene	0.05	nd	0.10	nd	nd	nd	0.10	0	0.1	nd	nd	nd	nd	0.19	
2	Acenaphthylene	0.05	nd	nd	nd	nd	nd		--	0.1	nd	nd	nd	nd	nd	
6	Anthracene	0.05	nd	0.20	nd	nd	nd	0.20	0	0.1	nd	nd	0.11	nd	nd	
9	Benzo (a) anthracene	0.05	nd	0.10	0.10	nd	nd	0.10	0	0.1	0.26	0.33	0.89	nd	nd	
13	Benzo (a) pyrene	0.05	nd	0.10	0.20	nd	nd	0.10	0	0.1	0.32	0.48	1.34	nd	nd	
11	Benzo (b) fluoranthene	0.05	nd	0.20	0.40	nd	nd	0.20	0	0.1	0.70	1.11	2.74	nd	nd	
16	Benzo (ghi) perylene	0.05	nd	0.10	0.20	nd	nd	0.10	0	0.2	0.31	0.50	1.42	nd	nd	
12	Benzo (k) fluoranthene	0.05	nd	nd	0.10	nd	nd		--	0.1	0.18	0.29	0.85	nd	nd	
10	Chrysene	0.05	nd	0.20	0.40	nd	nd	0.20	0	0.1	0.54	0.80	1.91	nd	nd	
15	Dibenzo (a,h) anthracene	0.05	nd	nd	nd	nd	nd		--	0.2	nd	(0.11)	0.32	nd	nd	
7	Fluoranthene	0.05	nd	0.50	1.00	nd	nd	0.50	0	0.1	1.12	1.60	3.08	nd	nd	
4	Fluorene	0.05	nd	0.10	nd	nd	nd	0.10	0	0.1	nd	nd	nd	nd	nd	
14	Indeno (1,2,3-cd) pyrene	0.05	nd	0.10	0.20	nd	nd	0.10	0	0.2	0.32	0.56	1.57	nd	nd	
1	Naphthalene	0.05	nd	0.10	nd	nd	nd	0.10	0	0.1	nd	nd	nd	nd	0.14 J	
5	Phenanthrene	0.05	nd	0.30	0.30	nd	nd	0.20	***40***	0.1	0.49	0.67	1.11	nd	nd	
8	Pyrene	0.05	nd	0.30	0.60	nd	nd	0.30	0	0.1	0.85	1.15	2.36	nd	nd	

Table 3.3.2a. Oil and grease (hexane extractable) data for grab samples collected during the "rise to peak flow" of stormwater events in the Long Creek and Red Brook watersheds. An asterisk (*) indicates that the lab analysis report stated that one of the duplicate samples had a value that was under the PQL (practical quantitation level) [5.0 mg/L]. Therefore, the field duplicate precision (RPD) value for these samples was stated as a range of possible values. "RPD" = Relative percent difference.

STORM 1

Date: 3/28/2000

Time	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		
				PQL = 5.0 mg/L		
				mg/L		
7:15	LC	Maine Mall	LC-S-0.186	< 5.0		The lab analyzed the temperature blanks when they received the samples. Temperatures blanks for the three sample coolers ranged from 9.2 - 11.0°C. The recommended temperature for sample storage was 2.0 - 6.0 °C. The lab did note that, since samples were dropped off at the lab immediately after sampling, there probably was insufficient time for the temperature blanks to cool down.
8:56	LC	Maine Mall	LC-S-0.186	< 5.0		
11:05	LC	Maine Mall	LC-S-0.186	< 5.0		
7:20	LC	DUP (Maine Mall)	LC-S-0.186-D	--		
9:00	LC	DUP (Maine Mall)	LC-S-0.186-D	< 5.0		
11:08	LC	DUP (Maine Mall)	LC-S-0.186-D	< 5.0		
8:06	LC	Mall Plaza	LC-M-0.595	< 5.0		
9:52	LC	Mall Plaza	LC-M-0.595	< 5.0		
11:50	LC	Mall Plaza	LC-M-0.595	< 5.0		
7:47	LC	Jetport	LC-N-0.585	< 5.0		
9:22	LC	Jetport	LC-N-0.585	< 5.0		
11:30	LC	Jetport	LC-N-0.585	< 5.0		
8:25	RB	Fairfield Inn	RB-1.694	< 5.0		
10:24	RB	Fairfield Inn	RB-1.694	< 5.0		
12:15	RB	Fairfield Inn	RB-1.694	< 5.0		

Report Limit:		5.0 mg/L
Stated QAPP Accuracy Limits:		±14%
Accuracy Results		-6%
Stated QAPP Field Duplicate Precision (RPD):		±30%
Field Duplicate Precision [FDP]	FDP 1	both values were below PQL
(Relative Percent Difference) Results	FDP 2	both values were below PQL
	FDP 3	both values were below PQL
Stated QAPP Lab Duplicate Precision (RPD):		±15%
Lab Duplicate (RPD) Results:		n/a (sample conc. < PQL)

Table 3.3.2a. cont'd.

STORM 2

Date: 10/18/2000

Time	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		
				PQL = 5.0 mg/L		
				mg/L		
2:05	LC	Maine Mall	LC-S-0.186	5		The lab analyzed the temperature blanks when they received the samples. Temperatures for the five sample coolers ranged from 0.5 - 1.5°C. The recommended temperature for sample storage was 2.0 - 6.0 °C.
2:53	LC	Maine Mall	LC-S-0.186	7.5		
5:29	LC	Maine Mall	LC-S-0.186	< 5.0		
2:27	LC	Mall Plaza	LC-M-0.595	< 5.0		
3:07	LC	Mall Plaza	LC-M-0.595	< 5.0		
5:44	LC	Mall Plaza	LC-M-0.595	< 5.0		
2:06	LC	Jetport	LC-N-0.585	7.3		
2:54	LC	Jetport	LC-N-0.585	7.9		
5:30	LC	Jetport	LC-N-0.585	6.3		
2:06	LC	DUP-Jetport	LC-N-0.585-D	8.6		
2:54	LC	DUP-Jetport	LC-N-0.585-D	< 5.0		
5:30	LC	DUP-Jetport	LC-N-0.585-D	< 5.0		
2:23	RB	Fairfield Inn	RB-1.694	8.2		
3:13	RB	Fairfield Inn	RB-1.694	7.5		
5:44	RB	Fairfield Inn	RB-1.694	< 5.0		
--	O	Field Blank	Field Blank	< 5.0		

Report Limit:		5.0 mg/L
Stated QAPP Accuracy Limits:		±14%
Accuracy Results		-3 to -6%
Stated QAPP Field Duplicate Precision (RPD):		±30%
Field Duplicate Precision [FDP]	FDP 1	16
(Relative Percent Difference) Results	FDP 2	**(47-200%)***
	FDP 3	**(25-200%)***
Stated QAPP Lab Duplicate Precision (RPD):		±15%
Lab Duplicate (RPD) Results:		n/a (sample conc. < PQL)

Table 3.3.2a. cont'd.

STORM 3

Date: 9/25/2001

Time	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		
				PQL = 5.0 mg/L		
				mg/L		
6:40 AM	LC	Maine Mall	LC-S-0.186	*Not collected*		
3:55 PM	LC	Maine Mall	LC-S-0.186	*during this*		
5:14 PM	LC	Maine Mall	LC-S-0.186	*event.*		
7:17 AM	LC	Mall Plaza	LC-M-0.595			
4:25 PM	LC	Mall Plaza	LC-M-0.595			
5:55 PM	LC	Mall Plaza	LC-M-0.595			
7:17 AM	LC	DUP-Mall Plaza	LC-M-0.595-D			
4:25 PM	LC	DUP-Mall Plaza	LC-M-0.595-D			
5:55 PM	LC	DUP-Mall Plaza	LC-M-0.595-D			
6:59 AM	LC	Jetport	LC-N-0.585			
4:09 PM	LC	Jetport	LC-N-0.585			
5:30 PM	LC	Jetport	LC-N-0.585			
7:33 AM	RB	Fairfield Inn	RB-1.694			
4:51 PM	RB	Fairfield Inn	RB-1.694			
6:14 PM	RB	Fairfield Inn	RB-1.694			
--	O	Field Blank	Field Blank			

[1] Oil & grease samples not collected during this event because of budget.

	Report Limit:	5.0 mg/L
	Stated QAPP Accuracy Limits:	±14%
	Accuracy Results	
	Stated QAPP Field Duplicate Precision (RPD):	±30%
Field Duplicate Precision [FDP]	FDP 1	
(Relative Percent Difference) Results	FDP 2	
	FDP 3	
	Stated QAPP Lab Duplicate Precision (RPD):	±15%
	Lab Duplicate (RPD) Results:	

Table 3.3.2b. Oil and grease (hexane extractable) data for grab samples collected during low flow conditions in the Long Creek and Red Brook watersheds. An asterisk (*) indicates that the lab analysis report stated that one of the duplicate samples had a value that was under the PQL (practical quantitation level) [5.0 mg/L]. Therefore, the field duplicate precision (RPD) value for these samples was stated as a range of possible values. "RPD" = Relative percent difference. Baseflow samples were collected between 9 am and 5 pm.

BASEFLOW 1

Date: 8/6/2000

	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		Oil & Grease Reported by Microbac (mg/L)
				PQL = 5.0 mg/L		(Katahdin had to subcontract to Microbac because they
				mg/L		lacked enough reagents.)
	LC	Hoyts	LC-S-0.186	< 5.0		1.0
	LC	Mall Plaza	LC-M-0.595	< 5.0		< 1.0
	LC	Service Merch.	LC-M-0.910	< 5.0		< 1.0
	LC	Sable Oakes	LC-M-2.270~	< 5.0		< 1.0
	LC	Goodyear	LC-Mn-2.274~	< 5.0		3.0
	LC	DUP (Goodyear)	LC-Mn-2.274~D	< 5.0		< 1.0
	LC	Jetport	LC-N-0.585	< 5.0		< 1.0
	RB	HQ	RB-0.071	< 5.0		< 1.0
	RB	Fairfield Inn	RB-1.694	< 5.0		1.1
	RB	Above RWS	RB-3.961	< 5.0		2.3

Report Limit:	5.0 mg/L
Stated QAPP Accuracy Limits:	±14%
Accuracy Results	-3 to -8%
Stated QAPP Field Duplicate Precision (RPD):	±30%
Field Duplicate Precision [FDP]	
(Relative Percent Difference) Results FDP 1	both values were below PQL
Stated QAPP Lab Duplicate Precision (RPD):	±15%
Lab Duplicate (RPD) Results:	n/a (sample conc. < PQL)

The lab analyzed the temperature blanks when they received the samples. Temperatures for the five sample coolers ranged from 13.8 - 15.7°C. The recommended temperature for sample storage was 2.0 - 6.0 °C. It was noted by the lab that the temp blank was not near the ice. Also, one of the two RB-3.961 sample bottles had not had H_2SO_4 preservative added in advance of sampling so it had to be added after sampling.

Table 3.3.2b. cont'd.

BASEFLOW 2

Date: 8/23/00

Time	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		
				PQL = 5.0 mg/L		
				mg/L		
	LC	Hoyts	LC-S-0.186	5.8		The lab analyzed the temperature blanks when they received the samples. Temperatures for the five sample coolers ranged from 1.4 - 2.1°C. The recommended temperature for sample storage was 2.0 - 6.0 °C.
	LC	Mall Plaza	LC-M-0.595	< 5.0		
	LC	Service Merch.	LC-M-0.910	< 5.0		
	LC	Sable Oakes	LC-M-2.270~	< 5.0		
	LC	Goodyear	LC-Mn-2.274~	< 5.0		
	LC	Jetport	LC-N-0.585	< 5.0		
	RB	HQ	RB-0.071	< 5.0		
	RB	Fairfield Inn	RB-1.694	< 5.0		
	RB	DUP - Fairfield	RB-1.694-D	< 5.0		
	RB	Above RWS	RB-3.961	< 5.0		
	BLANK	BLANK		< 5.0		

Report Limit:		5.0 mg/L
Stated QAPP Accuracy Limits:		±14%
Accuracy Results		-10%
Stated QAPP Field Duplicate Precision (RPD):		±30%
Field Duplicate Precision [FDP]		
(Relative Percent Difference) Results	FDP 1	both values were below PQL
Stated QAPP Lab Duplicate Precision (RPD):		±15%
Lab Duplicate (RPD) Results:		n/a (sample conc. < PQL)

Table 3.3.2. cont'd.

BASEFLOW 3

Date: 9/19/00

	Stream	Site	Site Code	Oil and Grease		NOTES
				(Hexane Extractable)		
				PQL = 5.0 mg/L		
				mg/L		
LC		Hoyts	LC-S-0.186	< 5.0		The lab analyzed the temperature blanks when they received the samples. Temperatures for the five sample coolers ranged from 1.0 - 1.2°C. The recommended temperature for sample storage was 2.0 - 6.0 °C.
LC		Mall Plaza	LC-M-0.595	< 5.0		
LC		DUP (Mall Plaza)	LC-M-0.595-D	< 5.0		
LC		Service Merch.	LC-M-0.910	< 5.0		
LC		Sable Oakes	LC-M-2.270~	< 5.0		
LC		Goodyear	LC-Mn-2.274~	< 5.0		
LC		Jetport	LC-N-0.585	< 5.0		
RB		HQ	RB-0.071	< 5.0		
RB		Fairfield Inn	RB-1.694	< 5.0		
RB		Above RWS	RB-3.961	< 5.0		
BLANK		BLANK		< 5.0		

Report Limit:	5.0 mg/L
Stated QAPP Accuracy Limits:	±14%
Accuracy Results	-14%
Stated QAPP Field Duplicate Precision (RPD):	±30%
Field Duplicate Precision [FDP]	
(Relative Percent Difference) Results FDP 1	both values were below PQL
Stated QAPP Lab Duplicate Precision (RPD):	±15%
Lab Duplicate (RPD) Results:	n/a (sample conc. < PQL)

Table 3.3.3. E. coli bacteria measured in samples collected throughout the Long Creek and Red Brook watersheds during both low flow and storm flow conditions. "Potential Violation of Class C 'Instantaneous' Standards" reflects the fact that E. coli must be of human origin for these exceedances to be in effect. These tests did not distinguish between human- and non-human-origin *E. coli*.

Site Code	Time	Count (for 1 ml dilution)	Count (for 10 ml dilution)	#/100 ml (under 1 ml dilution)	#/100 ml (under 10 ml dilution)	*Potential* for Violation of Class C "Instantaneous" Standards*? 1 mL dilution	10 mL dilution	Relative Percent Difference (Field Duplicate) (1 ml)	Relative Percent Difference (Field Duplicate) (10 ml)
Date: 9/19/00; Collector: Jeff Varricchione; Weather: clear, dry, low flow									
LC-S-0.186		14	43	1400	430	Y			
LC-S-0.470~		1	18	100	180				
LC-S-0.485~		7	17	700	170				
LC-M-0.595		4	18	400	180				
LC-M-0.910		10	29	1000	290	Y			
LC-M-2.270~		2	44	200	440				
LC-Mn-2.274~		1	5	100	50				
LC-N-0.585		9	95	900	950		Y		
RB-0.071		22	108	2200	1080	Y	Y		
RB-1.694		5	20	500	200				
RB-3.961		0	7	0	70				
Blank (lab)		0		0					
Date: 10/3/00; Collector: Jeff Varricchione; Weather: sunny, low flow									
LC-S-0.186		3	17	300	170				
LC-S-0.470~		1	32	100	320				
LC-S-0.485~		3	19	300	190				
LC-M-0.595		3	54	300	540				
LC-M-0.595 DUP		5	42	500	420			**50**	25
LC-M-0.910		2	42	200	420				
LC-M-2.270~		0	11	0	110				
LC-Mn-2.274~		4	11	400	110				
LC-Mn-3.000~		0	1	0	10				
LC-N-0.585		2	92	200	920				
RB-0.071		1	8	100	80				
RB-1.694		0	2	0	20				
RB-3.961		0	7	0	70				
Blank (lab)		0		0					
Date: 10/18/00; Collector: Jeff Varricchione, Maine DEP; Weather: samples collected during Storm #2									
LC-S-0.186	2:05 PM	4		400					
LC-S-0.186	2:53 PM	14		1400		Y			
LC-S-0.186	5:29 PM	9		900					
LC-M-0.595	2:27 PM	91		9100		Y			
LC-M-0.595	3:07 PM	61		6100		Y			
LC-M-0.595	5:44 PM	20		2000		Y			
LC-N-0.585	2:06 PM	5		500					
LC-N-0.585	2:54 PM	6		600					
LC-N-0.585	5:30 PM	11		1100		Y			
LC-N-0.585 DUP	2:06 PM	6		600				18	
LC-N-0.585 DUP	2:54 PM	8		800				29	
LC-N-0.585 DUP	5:30 PM	9		900				20	
RB-1.694	2:23 PM	0		0					
RB-1.694	3:13 PM	1		100					
RB-1.694	5:44 PM	4		400					
Blank (field)	--	0		0					

Table 3.5.1. Dates during which stream discharge was measured at sites in the Long Creek and Red Brook watersheds. An asterisk refers to the fact that some rain events occurred in more than one pulse, as indicated by the text in parentheses. More complete climatalogical data is provided in Appendix E.

Event	Date(s)	Precipitation Amount During Period of Heaviest Rainfall (inches) (A)	* Duration (hours) (A)	Precipitation Amount During First 24 Hours (inches) (B)	Duration (hours) (B)	Total Precipitation (inches) (C)	Duration (hours) (C)	Time Since Last Hourly Rainfall of > 0.01" (days) (D)	24-Hour Precipitation of Last Rainfall Event Having > 0.01" (inches) (E)	Time Since Last Rain Event Having > 0.50" in a 24-Hour Period (days) (F)
Storm Event 1	3/28/00 - 3/29/00	1.3	7	1.5	24	1.6	29	--	--	--
Storm Event 2	10/18/00 - 10/19/00	1.1	21	1.1	24	1.1	21	--	--	--
Storm Event 3 - *a*	9/25/01 - 9/26/01	0.1	(1^{st}) 12	1.7	24	1.7	24	--	--	--
Storm Event 3 - *b*	9/25/01 - 9/26/01	1.6	(2^{nd}) 12	--	--	--	--	--	--	--
ISCO Calibration Event 1	11/10/00 - 11/11/00	1.3	26	1.3	24	1.3	26	--	--	--
ISCO Calibration Event 2	9/21/01 - 9/22/01	1.2	13	1.2	24	1.3	29	--	--	--
ISCO Calibration Event 3*a*	5/13/02 - 5/14/02	0.2	(1^{st}) 11	0.7	24	2.1	39	--	--	--
ISCO Calibration Event 3*b*	5/13/02 - 5/14/02	1.8	(2^{nd}) 22	--	--	--	--	--	--	--
Baseflow Event 1	8/22/00	--	--	--	--	--	--	3.3	0.06	7.5
Baseflow Event 2	9/19/00	--	--	--	--	--	--	3.9	0.53	3.9

Table 3.5.2. The amount of time it took the various flow monitoring stations to reach peak flow during the three storms sampled in the present study. During the September 2001 storm, LC-M almost reached peak flow after 12.2 hours, but it never truly reached peak flow until 21.8 hours.

SITE

DATE	LC-S	LC-M	RB
3/28/2000 - 3/29/2000	4.4 hr	10.6 hr	12.9 hr
10/18/2000 - 10/19/2000	20.2 hr	21.7 hr	27.1 hr
9/25/2001 - 9/26/2001	12.4 hr	(12.2) 21.8 hr	20.1 hr

Table 3.6.1. Location and date information for the rockbag macroinvertebrate sampling sites the Long Creek and Red Brook watersheds.

Site Code	Alternative Name	Habitat Type	Sampling Method	DEP Log No.	River Basin	Coordinates - Latitude	Coordinates - Longitude	Township	Stream Order	Stream Gradient (from topo) %	Date Sampler Set	Date Sampler Retrieved	Collectors	Notes
			a	a	a	a	a	a	a	a	a	a	a	
LC-S-0.369	Hoyts	sandy run	Rockbag	849	Presumpscot/Fore	43° 37' 58"	70° 19' 17"	S. Portland	1	0.52	8/5/99	8/31/99	JV, DK, MED	Middle rockbag covered by about 6 inches of sand on pick-up date.
LC-M-0.380	V-Tec RW	sandy run	Rockbag	851	Presumpscot/Fore	43° 38' 06"	70° 19' 33"	S. Portland	2	0.36	8/5/99	9/2/99	JV, GB	
LC-M-0.910	Service Merchandise	sandy run	Rockbag	852	Presumpscot/Fore	43° 38' 22"	70° 19' 42"	S. Portland	2	0.36	8/5/99	8/31/99	JV, DK, MED	
LC-M-2.270	Sable Oaks	sandy run	Rockbag	854	Presumpscot/Fore	43° 38' 51"	70° 20' 54"	Westbrook	1	0.30	8/6/99	9/2/99	JV, GB	
LC-Mn-2.274	Goodyear	sandy run	Rockbag	853	Presumpscot/Fore	43° 38' 53"	70° 20' 54"	Westbrook	1	0.31	8/6/99	9/2/99	JV, GB	
LC-N-0.415	V-Tec LW	sandy run	Rockbag	850	Presumpscot/Fore	43° 38' 07"	70° 19' 33"	S. Portland	2	0.43	8/5/99	9/2/99	JV, GB	
RB-0.071	HQ	sandy run	Rockbag	855	Presumpscot/Fore	43° 37' 40"	70° 19' 31"	S. Portland	2	0.17	8/6/99	8/31/99	JV, DK, MED	
RB-1.474	La-z-boy	sandy run	Rockbag	856	Presumpscot/Fore	43° 37' 35"	70° 20' 43"	Scarborough	2	0.37	8/5/99	9/3/99	JV	Also, when I left rockbags on point bar (after they had been cleaned of inverts) until the time I returned, I found one of the rockbags 60% buried in sand. (There must have been a storm prior to my return.)
RB-3.961	RWS	sandy run	Rockbag	857	Presumpscot/Fore	43° 38' 22"	70° 22' 46"	Scarborough	1	0.42	8/5/99	9/3/99	JV	

Table 3.6.2. Location and date information for the multi-habitat macroinvertebrate sampling sites the Long Creek and Red Brook watersheds.

	Sample Collection...					[Indicate the number of jabs / kicks taken in each habitat type]												
Site Code	Habitat Type	Sampling Method	How was sample collected?	Date Sample Was Collected	Time	Riffles	Stream Banks	Snags	Banks	Leaf Packs	Submerged Macro-phytes	Other (sand)	General Comments	Date Habitat Analysis Was Performed	Weather Now	Weather Over Past 24 Hours	Has There Been a Heavy Rain in the Past 7 Days?	Notes About Site
LC-S-0.016	sandy-silty run	D-frame net	wading	9/26/99	2:30 PM	0	0	3	2	2	0	3						
LC-S-0.369	sandy-silty run	D-frame net	wading	9/22/99	11:00 AM	0	0	3	2	2	0	3	Sampled 5 days after a 4.4" rainfall and 12 hrs after after a 0.06" rainfall; very close to baseflow; sand was deposited on the floodplain & the vegetation appears to have been blown down by flooding	10/11/99	clear / sunny	clear / sunny	No	
LC-S-0.496	sandy-silty run w/ macro-phytes	D-frame net	wading	9/26/99	5:00 PM	0	0	2	0	0	6	2		10/24/00	clear / sunny	clear / sunny	1.1" 5 days ago	
LC-M-0.380	sandy-silty run	D-frame net	wading	9/22/99	1:30 PM	0	0	3	2	2	0	3		10/11/99	clear / sunny	clear / sunny	No	2 large culverts upstream of this site are pointed directly at a steep, long streambank. Property at the top of the hill appears as though it will be threatened in a few years.
LC-M-0.533	riffle	D-frame net	wading	9/24/99	2:30 PM	10	0	0	0	0	0	0	The riffle appears to exist mainly because of road and riprap debris, although is a little bit of bedrock outcropping on on bank.	10/24/00	clear / sunny	clear / sunny	1.1" 5 days ago	Riffle appears to be a result of road-building debris. This was confirmed after seeing a 1980's photo in an IF&W photograph.
LC-M-0.910	sandy-silty run	D-frame net	wading	9/23/99	11:00 AM	0	0	3	2	2	0	3		10/11/99	clear / sunny	clear / sunny	No	Appears to be some petroleum flecks on the surface of the water, especially below the "Service Merchandise" storm outlet.
LC-M-2.191	riffle	D-frame net	wading	9/24/99	3:30 PM	10	0	0	0	0	0	0	Less cobble and more silt than LC Dunkin Donuts site; big, slow scour pool upstream of this site.					
LC-M-2.270	sandy-silty run	D-frame net	wading	9/23/99	12:00 PM	0	0	3	2	2	0	3		10/11/99	clear / sunny	clear / sunny	No	
LC-Mn-2.274	sandy-silty run	D-frame net	wading	9/23/99	12:30 PM	0	0	3	2	2	0	3		10/11/99	clear / sunny	clear / sunny	No	
LC-Mw-2.896	sandy-silty run	D-frame net	wading	9/26/99	10:30 AM	0	0	3	2	2	0	3		11/3/00	80% cloud cover	clear / sunny	No (but did get ~ 0.3" 3 days ago)	Study site is immediately above a powerline clearing. Nearby, on the other fork of the main branch of LC (basically the reach between the Jordan' Meats and Spring St.), is an impoundment that backs up a lot of water also results in a lot of emergent macrophytes upstream of the dam and a lot of submergent macrophytes downstream of the dam. This situation probably is the factor which explains low DO values on this branch.
LC-N-0.415	sandy-silty run w/ some pea gravel	D-frame net	wading	9/22/99	12:00 PM	0	0	3	2	2	0	3	Saw some minnows.	10/11/99	clear / sunny	clear / sunny	No	
LC-N-0.850~	sandy-silty run	D-frame net	wading	9/26/99	2:00 PM	0	0	3	2	2	0	3		11/2/00	clear / sunny	80% cloud cover	No (but did get ~ 0.3" 2 days ago)	There is a some of junk/debris at this site. The channel is fairly constrained (by fill?) from Rt. 9 to about Gold's Gym. About 100 m below Gold's Gym, the area opens up into a much less confined area (a powerline runs through here and a lot of the landscape is covered by cattails. Then the channel begins to braid through a bunch of vegetated clay islands. Eventually, the channel becomes sinuous again. Trash continues to be a problem.
RB-0.071	sandy-silty run	D-frame net	wading	9/23/99	3:30 PM	0	0	3	2	2	0	3	Some blue-green algae (slimes), I believe.	10/12/99	clear / sunny	clear / sunny	No	
RB-1.474	sandy-silty run	D-frame net	wading	9/24/99	12:30 PM	0	0	3	2	2	0	3		10/12/99	clear / sunny	clear / sunny	No	Banks are downcutting much faster than RWS (reference site).
RB-1.500~	riffle	D-frame net	wading	9/25/99	4:00 PM	10	0	0	0	0	0	0			clear / sunny	clear / sunny		
RB-3.961	sandy-silty run	D-frame net	wading	9/23/99	4:30 PM	0	0	3	2	2	0	3		10/12/99	clear / sunny	clear / sunny	No	

Table 3.6.2 cont'd.

Site Code	Date Analysis Performed	Weather Now	Weather Over Past 24 Hours	Has There Been a Heavy Rain in the Past 7 Days?	Notes About Site
LC-M-0.020~	11/2/00	50% cloud cover	50% cloud cover	No (but did get ~ 0.3" 2 days ago)	
LC-M-0.603	11/2/00	clear / sunny	50% cloud cover	No (but did get ~ 0.3" 2 days ago)	
LC-M-1.653	11/3/00	40% cloud cover	clear / sunny	No (but did get ~ 0.3" 3 days ago)	In the upper part of this reach, the channel is headed towards a big hill and it is starting to eat away at the hill (slowly). Fortunately, the hill is well-vegetated, so the there is some cohesion of the bank materials. For the remainder (& majority) of the reach, there is a lot of room for lateral migration and fairly good access to the floodplain.
LC-M-3.098	10/27/00	85% cloud cover	85% cloud cover	No	
LC-Mn-3.224~	11/3/00	70% cloud cover	clear / sunny	No (but did get ~ 0.3" 3 days ago)	
LC-N-0.585	11/2/00	clear / sunny	80% cloud cover	No (but did get ~ 0.3" 2 days ago)	

Table 3.6.3. Channel substrate and aquatic vegetation conditions at the biotic sampling sites in the Long Creek and Red Brook watersheds. For more information about the measures, see the Results section. *[Numbers in brackets refer to sites that appeared to have diatoms present, but apparently no other types of aquatic vegetation.]

	Organic Substrate Components (Do not necessarily add up to 100%)				Sediment / Substrate				Aquatic Vegetation.....	
Site Code	Detritus (sticks, wood, coarse plant materials) [CPOM]	Muck-Mud (black, very fine organic) [FPOM]	Marl (grey, shell fragments)		Odors	Oils	Deposits (of sludge, sawdust, paper fiber, relict shells)		Indicate the dominant type and record the dominant species present.	Portion of the reach with aquatic vegetation (%) *
LC-S-0.016	n/a	n/a	n/a		n/a	n/a	n/a		n/a	n/a
LC-S-0.369	35	50	0		Normal	Not observed	Not observed		Diatoms	*[25]*
LC-S-0.496	40	15	0		Slightly anaerobic	Not observed	Not observed		Rooted submergent, rooted emergent, attached algae	90
LC-M-0.380	20	50	0		Normal	Not observed	Not observed		Rooted submergent (grasslike); Diatoms	25
LC-M-0.533	10				Normal	Not observed	Not observed		Rooted submergent	5
LC-M-0.910	30	40	0		Normal	Not observed	Sand		Rooted submergent (grasslike); Diatoms	30
LC-M-2.191	n/a	n/a	n/a		n/a	n/a	n/a		n/a	n/a
LC-M-2.270	50	70	0		Slightly anaerobic	Not observed	Not observed		Rooted submergent (grasslike); Diatoms	25
LC-Mn-2.274	25	40	0		Normal	Not observed	Not observed		Diatoms	*[20]*
LC-Mw-2.896	80				Normal	Not observed	Not observed		--	--
LC-N-0.415	40	40	0		Normal	Not observed	Not observed		Diatoms	*[25]*
LC-N-0.850~	20				Normal - slightly anaerobic	Slight	Not observed		Rooted emergent	5
RB-0.071	30	50	0		Normal	Not observed	Not observed		Diatoms	*[25]*
RB-1.474	15	70	0		Normal	Not observed	Not observed		Diatoms	*[25]*
RB-1.500~	n/a	n/a	n/a		n/a	n/a	n/a		n/a	n/a
RB-3.961	30	60	0		Normal	Not observed	Not observed		Diatoms (less than 5% area having macrophytes)	*[25]*

Table 3.6.3. cont'd

	Organic Substrate Components (Do not necessarily add up to 100%)				Sediment / Substrate				Aquatic Vegetation.....	
Site Code	Detritus (sticks, wood, coarse plant materials) [CPOM]	Muck-Mud (black, very fine organic) [FPOM]	Marl (grey, shell fragments)		Odors	Oils	Deposits		Indicate the dominant type and record the dominant species present.	Portion of the reach with aquatic vegetation (%)
LC-M-0.020~	Too deep to tell	Too deep to tell			Normal	Not observed	Not observed		Too deep to tell	?
LC-M-0.603	20				Normal - slightly anaerobic	Not observed	Not observed		Attached algae	5
LC-M-1.653	40				Normal	Slight	Not observed		Rooted submergent (near the periphyton sampling site)	35
LC-M-3.098	20				Normal - slightly anaerobic	Not observed	Not observed		Rooted emergent; Rooted submergent	40
LC-Mn-3.224~	50				Normal	Not observed	Not observed			0
LC-N-0.585	20				Normal	Not observed	Not observed		Attached algae	5

Table 3.6.4. Riparian zone and water quality observations at the biotic sampling sites in the Long Creek and Red Brook watersheds.
"Dn", "Mid", and "Up" stand for downstream, midstream, and upstream rockbags, respectively.

	Riparian Vegetation				%shaded canopy (measured with densiometer)					[2]	Water Quality.....		
Site Code	Indicate the most dominant type.	Indicate the 2nd most dominant type.	Indicate the 3rd most dominant type.	Canopy Cover	%shaded canopy : DN	%shaded canopy: MID	%shaded canopy : UP	**% Shaded Canopy : Average for Site**	**std. dev.** (% Shaded Canopy)	**Stream Cover (% shaded)**	Odors	Surface Oils	Turbidity
LC-S-0.016	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
LC-S-0.369	trees	grasses	herbaceous	Partly open	90.4	90.4	92.2	**91.0**	**1.1**	dense	Normal	Flecks	Slightly turbid
LC-S-0.496	trees	grasses	herbaceous	Partly shaded							Normal	Sheen (in a few spots)	Slightly turbid
LC-M-0.380	trees	herbaceous	grasses	Partly open	88.0	83.4	84.7	**85.4**	**2.4**	dense	Normal	Slight presence	Turbid
LC-M-0.533	grasses	herbaceous	trees	Partly open							Normal	None observed	Slightly turbid
LC-M-0.910	trees	herbaceous	grasses	Partly shaded	79.7	78.4	80.0	**79.4**	**0.8**	dense	Normal	Small presence of slicks	Slightly turbid
LC-M-2.191	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
LC-M-2.270	herbaceous	grasses	trees	Partly open	87.0	75.6	81.5	**81.4**	**5.7**	dense	Normal	None observed	Slightly turbid
LC-Mn-2.274	trees	grasses	herbaceous	Partly open	93.2	89.9	89.3	**90.8**	**2.1**	dense	Normal	None observed	Slightly turbid
LC-Mw-2.896	trees	grasses	herbaceous	Partly open							Normal	None observed	Slightly turbid
LC-N-0.415	trees	herbaceous	grasses	Partly open	85.2	88.0	91.2	**88.1**	**3.0**	dense	Normal	Slight presence	Slightly turbid
LC-N-0.850~	shrubs	herbaceous	trees	Partly shaded							Normal	None observed	Slightly stained
RB-0.071	trees	grasses	herbaceous	Shaded	90.1	90.9	92.2	**91.1**	**1.1**	dense	Normal	Slight presence	Slightly turbid
RB-1.474	trees	grasses	herbaceous	Shaded	93.5	91.4	94.3	**93.1**	**1.5**	dense	Normal	None observed	Stained
RB-1.500~	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RB-3.961	trees	grasses	herbaceous	Shaded	93.5	89.3	89.9	**90.9**	**2.3**	dense	Normal	Flecks	Stained

Table 3.6.4 cont'd.

	Riparian Vegetation											Water Quality.....		
Site Code	Indicate the most dominant type.	Indicate the 2nd most dominant type.	Indicate the 3rd most dominant type.	Canopy Cover								Odors	Surface Oils	Turbidity
LC-M-0.020~	trees	herbaceous	grasses	Partly open								Normal	None observed	Turbid
LC-M-0.603	trees	herbaceous	grasses	Partly open								Normal	None observed	Turbid
LC-M-1.653	trees	herbaceous	grasses	Partly open								Normal	None observed	Slightly turbid
LC-M-3.098	trees	herbaceous	grasses	Partly open								Normal	None observed	Clear
LC-Mn-3.224~	trees	--	--	Shaded								Normal	None observed	Clear
LC-N-0.585	trees	herbaceous	grasses	Partly open								Normal	Globs of orange slime (iron bacteria?)	Slightly turbid

Table 3.6.5. Channel morphology and water velocity conditions at the biotic sampling sites in the Long Creek and Red Brook watersheds. "Dn", "Mid", and "Up" stand for downstream, midstream, and upstream rockbags, respectively. Note: The Globe flow probe was not sensitive enough in this situation, so velocity was measured using floating detritus at the rockbag sites. "Est." represents "estimated".

	In-Stream Features.....			Proportion of Stream Represented by Stream Morphology Types (%)			Sampler Placement.....[5].....										[5].....				[5].....
Site Code	Est. Stream Width (m)	Est. Stream Depth (m)	Est. Reach Length Used in Habitat Analysis (m)	Riffle	Run	Pool	width Dn (m)	width Mid (m)	width Up (m)	**width mean (m)**	s.d.	depth Dn (cm)	depth Mid (cm)	depth Up (cm)	**depth mean (cm)**	s.d.	velocity Dn (cm/s)	velocity Mid (cm/s)	velocity Up (cm/s)	**velocity mean (cm/s)**	s.d.
LC-S-0.016	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LC-S-0.369	2	0.35	100	0	80	20	2.00	1.51	2.13	1.88	0.33	30	25	33	29	4	0.42	0.36	0.36	0.4	0.0
LC-S-0.496	2	0.4	175	0	100	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LC-M-0.380	5	0.4	100	0	70	30	4.70	5.00	5.30	5.00	0.30	40	40	36	39	2	0.42	0.36	0.36	0.4	0.0
LC-M-0.533	4	0.6	100	10	50	40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LC-M-0.910	2.4	0.3	100	0	60	40	2.30	2.60	2.10	2.33	0.25	26	24	30	27	3	0.51	0.64	0.51	0.6	0.1
LC-M-2.191	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LC-M-2.270	1.5	0.2	100	0	80	20	1.10	1.50	1.20	1.27	0.21	16	20	16	17	2	0.64	0.85	0.51	0.7	0.2
LC-Mn-2.274	1.3	0.2	100	0	80	20	1.20	1.30	1.20	1.23	0.06	23	20	17	20	3	0.51	0.51	0.64	0.6	0.1
LC-Mw-2.896	0.8	0.2	100	0	80	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
LC-N-0.415	2.5	0.25	100	0	75	25	2.80	2.50	2.50	2.60	0.17	22	25	24	24	2	0.85	0.85	0.64	0.8	0.1
LC-N-0.850~	1.5	0.2	200	5	70	25	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RB-0.071	4	0.35	100	0	70	30	3.70	3.30	3.40	3.47	0.21	34	29	22	28	6	0.51	0.51	0.64	0.6	0.1
RB-1.474	3.5	0.3	100	0	50	50	3.50	3.20	2.90	3.20	0.30	30	29	26	28	2	0.64	0.51	0.51	0.6	0.1
RB-1.500~	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RB-3.961	2.5	0.3	100	5	55	40	2.40	2.60	3.40	2.80	0.53	18	25	32	25	7	0.64	0.64	0.85	0.7	0.1

Table 3.6.5. cont'd.

	In-Stream Features.....			Proportion of Stream Represented by Stream Morphology Types (%)		
Site Code	ed Stream Width (m)	ed Stream Depth (m)	Reach Length Used in Habitat Analysis (m)	Riffle	Run	Pool
LC-M-0.020~	6	1	200	0	30	70
LC-M-0.603	3.5	0.6	200	5 (riprap?)	35	60
LC-M-1.653	2.5	0.7	200	0	50	50
LC-M-3.098	0.5	0.15	200	0	60	40
LC-Mn-3.224~	1	0.2	70	5	65	30
LC-N-0.585	2	0.15	200	5 (riprap?, junk/bricks)	60	35

Table 3.6.6. Land-use, water velocity, and impoundment observations at the biotic sampling sites in the Long Creek and Red Brook watersheds.

Physical Characterization & Some Water Quality Information

Watershed Features..... In-Stream Features.....

Site Code	Predominant Surrounding Landuse	Local Watershed NPS Pollution	Local Watershed Erosion	Channelized ?	Dam Present ?	Terrain / Land Use (a)	Terrain / Land Use (b)
LC-S-0.016	n/a	n/a	n/a	n/a	n/a	n/a	n/a
LC-S-0.369	Commercial	Obvious Sources	Moderate	No	No	urban	rolling
LC-S-0.496	Commercial	Obvious sources	Moderate	Yes	No	n/a	n/a
LC-M-0.380	Riparian Forest, Commercial	Obvious Sources	Moderate	Upstream culverts direct flow at a steep bank	No	urban	rolling
LC-M-0.533	Commercial	Obvious sources	Moderate	Yes	No	n/a	n/a
LC-M-0.910	Commercial	Obvious Sources	Moderate	No	No	urban	rolling
LC-M-2.191	n/a	n/a	n/a	n/a	n/a	n/a	n/a
LC-M-2.270	Golf course	Obvious Sources	Moderate	No	Upstream ~ 0.5 mile	(golf course); upland conifer; urban	rolling
LC-Mn-2.274	Industrial Park	Obvious Sources	Moderate	Maybe	Upstream ~ 0.7 mile	upland conifer; urban	rolling
LC-Mw-2.896	Forest	Obvious sources	None	No	No	n/a	n/a
LC-N-0.415	Riparian Forest, Commercial	Obvious Sources	Moderate	Yes	No	urban	rolling
LC-N-0.850~	Commercial	Obvious sources	Moderate	Some channelization upstream of Gold's Gym	No	n/a	n/a
RB-0.071	Forest, Interstate	Obvious Sources	None	No	No	urban; upland/swamp conifer	rolling
RB-1.474	Riparian Forest, Commercial	Obvious Sources	Moderate	Maybe	No	upland/swamp hardwood; urban	rolling
RB-1.500~	n/a	n/a	n/a	n/a	n/a	n/a	n/a
RB-3.961	Forest; Junkyard & Landfill Nearby	Some Potential Sources	None	No	No	upland/swamp hardwood; upland/swamp conifer	rolling

Table 3.6.6 cont'd.

	Watershed Features.....			In-Stream Features.....	
Site Code	Predominant Surrounding Landuse	Local Watershed NPS Pollution	Local Watershed Erosion	Channelized ?	Dam Present ?
LC-M-0.020~	Commercial	Obvious sources	Moderate	No	Yes - ~ 0.5 mile downstream
LC-M-0.603	Commercial	Obvious sources	Heavy	No (but might be a newly-formed channel due to large stormwater quantities)	No
LC-M-1.653	Forest (although a golf course & an airport clearance zone are a few hundred meters away on either side).	Some potential sources	Moderate	No	No
LC-M-3.098	Wetland / Commercial	Some potential sources	Moderate	No	No
LC-Mn-3.224~	Forest	Some potential sources	None	No	No
LC-N-0.585	Commercial	Obvious sources	Heavy	No	No

Table 3.6.7. Field notes on observations of various organisms at the biotic sampling sites in the Long Creek and Red Brook watersheds. 0 = not observed; 1 = rare; 2 = common; 3 = abundant; 4 = dominant.

Qualitative Listing of Aquatic Biota.....

Site Code	Periphyton [(in the form of diatoms) was believed to form a coating on the woody debris in the stream.]	Filamentous Algae	Macro-phytes	Slimes	Macro-invertebrates	Fish		**observations about local biotic community**
LC-S-0.016	1	0	0	0	2	0		
LC-S-0.369	1	0	0	0	2	0		some periphyton.; few macrophytes; few macroinverts
LC-S-0.496	1	1	3	1	3	0		
LC-M-0.380	1	0	0	0	2	0		some peri.;some filamentous algae; some macrophytes; few macroinverts
LC-M-0.533	2	2	1	1	4	0		
LC-M-0.910	1	0	2	0	2	0		some peri.;no macrophytes, but common dwnstrm; few macroinverts; few minnows
LC-M-2.191	2	2	1	1	3	0		
LC-M-2.270	1	0	2	0	2	1		some peri.;some filamentous algae; no macrophytes, but some nearby; few macroinverts
LC-Mn-2.274	1	0	1	1	2	2		some peri.;some filamentous algae; some macrophytes; some blue green algae; few macroinverts; some minnows
LC-Mw-2.896	1	0	1	0	2	0		
LC-N-0.415	1	0	0	0	2	2		some peri.;some filamentous algae.; few macroinverts
LC-N-0.850~	1	0	1	0	2	1		
RB-0.071	1	0	0	1	2	0		some peri.; few macrophytes; few macroinverts; few fish (minnows?); some blue green algae
RB-1.474	1	0	0	1	2	0		some peri.; few macroinverts
RB-1.500~	2	2	1	1	3	0		
RB-3.961	1	0	0	0	2	0		some peri.; macroinverts common; few minnows

Table 3.6.7 cont'd.

Qualitative Listing of Aquatic Biota.....

Site Code	Periphyton [(in the form of diatoms) was believed to form a coating on the woody debris in the stream.]	Filamentous Algae	Macro-phytes	Slimes	Macro-invertebrates	Fish		**observations about local biotic community**
LC-M-0.020~								
LC-M-0.603								
LC-M-1.653								
LC-M-3.098								
LC-Mn-3.224~								
LC-N-0.585								

Table 3.6.8. Channel and riparian habitat assessment data using USEPA Rapid Bioassessment Protocols (1999) for low-gradient streams.

Habitat Assessment - Low Gradient Streams (USEPA Rapid Bioassessment Protocols).....

Site Code (# = Stream Mile)	Date	1 Epifaunal Substrate / Available Cover	2 Pool Substrate Character-ization	3 Pool Variability	4 Sediment Deposition	5 Channel Flow Status	6 Channel Alteration	7 Channel Sinuousity	8-l Bank Stability *left*	8-r Bank Stability *right*	9-l Vegetative Protection *left*	9-r Vegetative Protection *right*	10-l Riparian Vegetative Zone *left*	10-r Riparian Vegetative Zone *right*	TOTAL SCORE	RANK	Notes
MAX SCORE:		**20**	**20**	**20**	**20**	**20**	**20**	**20**	**10**	**10**	**10**	**10**	**10**	**10**	**200**		
LC-S-0.369	10/11/99	7	8	8	8	18	14	13	6	6	8	8	7	7	118	9	
LC-M-0.380	10/11/99	11	8	12	10	17	15	8	7	3	8	6	9	6	120	8	
LC-M-0.910	10/11/99	12	9	12	17	18	18	14	9	9	10	10	6	5	149	2	
LC-M-2.270~	10/11/99	13	10	7	18	18	14	14	8	9	7	7	5	3	133	7	These scores are applicable for the local area, but apparently not so for areas upstream in the golf course area (more encroachment on the stream)
LC-Mn-2.274~	10/11/99	12	8	10	18	19	14	12	9	9	8	8	5	9	141	4	
LC-N-0.415	10/11/99	13	10	12	11	16	17	9	7	7	10	10	8	5	135	6	Storm drain outlets are upstream.
RB-0.071	10/12/99	14	11	10	11	18	16	14	9	9	8	8	9	9	146	3	Culverts (and interstate drainage?) upstream.
RB-1.474	10/12/99	11	11	12	11	16	17	17	8	8	8	8	8	6	141	4	
RB-3.961	10/12/99	13	10	13	18	18	20	16	9	9	10	10	10	10	166	1	
vvv Data from 2000 vvv																	
LC-S-0.496	10/24/00	4	12	3	16	17	5	7	7	7	10	10	7	7	112		
LC-M-0.150~	11/2/00	9	9	13	12	19	18	17	8	8	10	10	8	9	150		Substrate variables were difficult to measure because the water chest deep here.
LC-M-0.380	10/24/00	13	15	14	11	13	13	8	7	4	8	8	8	6	128		
LC-M-0.533	10/24/00	16	17	13	18	18	9	5	4	4	7	7	6	6	130		
LC-M-0.603	11/2/00	5	11	13	13	18	12	6	1	1	8	8	4	4	104		Channel appears to been relocated due to high stormwater volumes coming out near the Service Merchandise shopping center complex.
LC-M-0.910	11/2/00	12	11	12	15	16	18	16	7	8	8	8	7	6	144		
LC-M-1.653	11/3/00	9	11	13	12	17	19	19	6	6	8	8	9	8	145		
LC-M-3.098	10/27/00	13	12	5	18	19	19	14	9	9	10	10	8	8	154		Culvert upstream of this site. Riparian vegetative zone width in the top 20 m of this reach was about <6 m due to a nearby parking lot.
LC-Mn-3.224~	11/3/00	15	16	13	12	16	20	17	8	8	10	10	10	10	165		
LC-Mw-2.896	11/3/00	8	7	7	18	19	18	10	8	8	10	10	10	10	143		
LC-N-0.595	11/2/00	10	14	7	11	10	13	10	4	4	8	8	3	3	105		
LC-N-0.850~	11/2/00	8	15	11	10	18	11	15	7	7	8	8	5	5	128		

Table 3.6.9. A) Comparison of woody debris abundances among various Long Creek and Red Brook sites as well as with Buzzards Branch in Virginia (Smock et al. 1989). B) The wood counts also were broken down into categories proposed by Kaufmann and Robison (EMAP - 1998) at the bottom of this page. [1]The "total # of pieces" listed at the bottom of section "a" included all wood with a mean diameter > 5 cm and being at least partially located within the bankfull channel area, including root masses. The percent that the channel was spanned was not considered here.

A)

Definition of dams: Any wood > 5cm in diameter and spanning > 1/4th the channel, including root masses.

	Buzzards Branch, VA	RB-3.500~	RB-2.100~	LC-Mn-2.600~	LC-Mn-2.274	LC-M-2.270	LC-M-0.910	LC-M-0.595	LC-M-0.533	LC-M-0.380
Length of Stream Surveyed (m)	300	100	100	100	100	100	100	100	100	100
Wood Diameter (cm)	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m	# dams / 100 m
5-10	1.7	35.0	25.0	0.0	18.0	22.0	14.0	8.0	2.0	12.0
10-20	2.7	19.0	16.0	0.0	9.0	5.0	3.0	8.0	0.0	9.0
>20	2.0	4.0	3.0	0.0	1.0	1.0	0.0	0.0	0.0	2.0
Root Mass	7.0	3.0	1.0	0.0	2.0	5.0	2.0	4.0	2.0	2.0
TOTAL # of Dams	**13.4**	**61.0**	**45.0**	**0.0**	**30.0**	**33.0**	**19.0**	**20.0**	**4.0**	**25.0**
[1]TOTAL # Pieces >5cm		**91.0**	**61.0**	**0.0**	**43.0**	**37.0**	**26.0**	**28.0**	**5.0**	**45.0**

B)

EMAP

diameter ; length (m)		RB-3.500~	RB-2.100~	LC-Mn-2.600~	LC-Mn-2.274	LC-M-2.270	LC-M-0.910	LC-M-0.595	LC-M-0.533	LC-M-0.380
		wood	wood	wood	wood	wood	wood	wood	wood	wood
0.1-0.3; 5.0-15.0 m		14	7			2	3	3		5
0.1-0.3; >15.0 m		4	1					1		1
0.3-0.6; 1.5 - 5.0 m			1							
0.3-0.6; 5.0-15.0 m		1				1				
0.3-0.6; >15.0 m										
0.6-0.8; 1.5 - 5.0 m										
0.6-0.8; 5.0-15.0 m										
0.6-0.8; >15.0 m										
>0.8; 1.5 - 5.0 m										
>0.8; 5.0-15.0 m										
>0.8; >15.0 m										
TOTAL		**19**	**9**	**0**	**0**	**3**	**3**	**4**	**0**	**6**

Table 3.7.1. Rosgen (1996) classification of study sites based upon channel cross-section measurements. Note that Rosgen's classification is meant for natural stream and river systems. The fact that there appears to have been much valley filling and channel relocation activities in addition to altered hydrological patterns (due to large amounts of impervious surfaces) suggests that many of these stream sections are currently going through readjustment to handle altered conditions, and may explain why some sections in the more urban areas did not classify well. A (n) indicates that the channel is suspected of being close to a natural form, while a (d) indicates that the channel is suspected of having departed from its natural condition [a disturbed reach]. At the right hand of the table, under the "matching" columns, an "X" indicates that cross-section measurements fell within Rosgen's predicted range. An "/" indicates that measurements fell with the predicted range after making "acceptable" adjustments to the measurements (e.g., + 0.2 units for certain measures, etc.) (Rosgen 1996).

											[---------- ROSGEN CLASSIFICATION ----------]							
											< Does the site match the category below for this particular class? >							
Stream	Date	Width of Flood-Prone Area (Wfpa) (ft)	Bankfull Width (W_{bkf}) (ft)	Entrench-ment Ratio (Wfpa / Wbkf)	Mean Bankfull Depth d_{bkf} (ft)	W / D Ratio (W_{bkf} / d_{bkf})	Slope (ft/ft)	Sinuosity	D50 Substrate Particle Class (mm)	D50 Substrate Particle Class	Entrench-ment?	W/D Ratio?	Slope?	Sinuousity ?	D50 Particle Class?	Rosgen Class-ification (Possible Classes)	Rosgen Class-ification (Suspected Class)	Notes
LONG CREEK SITES																		
Jetport Tributary																		
LC-N-0.404	12/1/00	29.8	8	3.73	0.5475	14.61	0.0041	1.08	0.31	sand	X	--	X	--	X	E5 (d)	**C5 (d)**	
											X	X	X	/	X	C5 (d)		
LC-N-0.595	12/7/00	18.58	8	2.32	0.8997	8.89	0.0050	1.26	0.21	sand	X	X	X	--	X	E5 (d)	**E5 (d)**	Sinuousity does not match (although it is close). This probably is due to the fact that much of the floodplain appears to have been filled in for development.
Main Stem Tributary																		
LC-M-0.050~	*4/24/00*	*n/a*	*25.42*	*n/a*	*1.6042*	*15.85*												*Water too deep to survey.*
LC-M-0.432	12/1/00	45.17	24.17	1.87	1.265	19.11	0.0022	1.09	0.32	sand	--	--	X	--	X	E5 (d)	**B5c (d)**	The upstream valley appears to have been affected by fill and channelization activities.
											--	X	X	/	X	F5 (d)		
											X	X	/	/	X	B5c (d)		
LC-M-0.603	11/29/00	25.67	16.67	1.54	1.676	9.95	0.0012	1.01	0.06	silt/clay	--	X	X	--	X	E6 (d)	**G6c (d)**	
											X	--	/	/	X	B6c (d)		
											/	X	/	/	X	G6c (d)		
LC-M-1.653	12/13/00	213	19.42	10.97	1.918	10.13	0.0002	1.60	0.07	sand	X	X	X	X	X	E5 (n)	**E5 (n)**	
LC-Mn-2.274	5/4/00	50.5	8.62	5.86	1.292	6.67	0.0017	1.18	0.06	silt/clay	X	X	X	--	X	E6 (d)	**E6 (d)**	Channelized?
LC-Mw-2.896	5/11/00	67.5	4.92	13.72	0.3616	13.61	0.0050	1.12	0.05	silt/clay	X	/	X	--	X	E6 (d)	**C6 (d)**	This site appeared to have been a relocated stream channel for development purposes.
											X	X	X	/	X	C6 (d)		

Table 3.7.1. Cont'd.

											[ROSGEN CLASSIFICATION]							
											< Does the site match the category below for this particular class? >							
Stream	Date	Width of Flood-Prone Area (Wfpa) (ft)	Bankfull Width (W_{bkf}) (ft)	Entrench-ment Ratio (Wfpa / Wbkf)	Mean Bankfull Depth d_{bkf} (ft)	W / D Ratio (W_{bkf} / d_{bkf})	Slope (ft/ft)	Sinuosity	D50 Substrate Particle Class (mm)	D50 Substrate Particle Class	Entrench-ment?	W/D Ratio?	Slope?	Sinuousity ?	D50 Particle Class?	Rosgen Class-ification (Possible Classes)	Rosgen Class-ification (Suspected Class)	Notes
Maine Mall Tributary																		
LC-S-0.220	4/17/00	111	11.83	9.38	1.002	11.81	0.0024	1.05	0.08	sand	X	X	X	--	X	E5 (d)	**E5 (d)**	Particle size distribution not actually measured here; assumed same as Hoyts.
LC-S-0.369	5/12/00	96.1	10.8	8.90	1.32	8.18	0.0022	1.17	0.08	sand	X	X	X	--	X	E5 (d)	**E5 (d)**	
RED BROOK SITES																		
RB-0.071	*5/18/00*	*REDO*	*17.8*	*REDO*	*1.14*	*15.61*												*Width of flood-prone not measured. Return at a later date.*
RB-1.434	12/7/00	185.75	11.75	15.81	1.488	7.90	0.0015	1.85	0.22	sand	X	X	X	X	X	E5 (n)	**E5 (n)**	
RB-2.119	5/20/00	123.33	10.25	12.03	1.253	8.18	0.0012	1.45	0.21	sand	X	X	X	/	X	E5 (n)	**E5 (n)**	
RB-3.961	12/8/00	52	11.83	4.40	0.9987	11.85	0.0019	1.49	0.08	sand	X	X	X	/	X	E5 (n)	**E5 (n)**	
Additional Sites																		
LC-M-0.533	11/21/01						0.0058	1.05	19.00 for whole reach									The floodplain appears to have been filled in for development purposes. The channel and banks appear to be lined with riprap (confirmed by a Maine IF&W photo from the 1980's).
LC-M-0.528~	11/21/01	24.17	16.58	1.46			0.0003	1.02	19.00 for whole reach									The floodplain appears to have been filled in for development purposes.
LC-M-0.910									0.08									
LC-M-3.098									0.05									

Table 3.7.2. Pfankuch Evaluations of channel stability for sites within in the Long Creek and Red Brook watersheds. See page 5 of this table for a summary of the evaluations.

Page 1

EXCELLENT

		Upper Banks				Lower Banks					Bottom						
Site #	**Date**	**Landform Slope**	**Mass Wasting**	**Debris Dam Potential**	**Vegetative Bank Protection**	**Channel Capacity**	**Bank Rock Content**	**Obstructions to Flow**	**Cutting**	**Deposition**	**Rock Angularity**	**Brightness**	**Consolidation of Particles**	**Bottom Size Distribution**	**Scouring & Deposition**	**Aquatic Vegetation**	**Total "Excellent" Score**
Question # :		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LC-S-0.369	10/24/00	2				1											3
LC-N-0.404	10/24/00	2			3	1											6
LC-M-0.432	10/24/00																0
LC-M-0.910	11/2/00	2			3	1											6
LC-Mn-2.274~	11/3/00				3												3
LC-M-2.270~																	n/a
RB-0.071	10/19/00																0
RB-1.434	10/19/00	2															2
RB-3.961	10/19/00	2	3		3												8
LC-M-0.533	10/24/00					1		2			1						4
RB-2.119	10/19/00									4							4
LC-Mw-2.896	11/3/00				3					5							8
LC-N-0.850~~	11/2/00				3												3
LC-M-1.640~	11/3/00	2			3												5
LC-M-1.663~	10/19/00					2											2
LC-N-0.595	11/2/00				3												3
LC-M-0.603	11/2/00				3												3
LC-M-0.020~~	11/2/00				3					4							7
LC-M-3.098	10/27/00	2	3		3	1			4	4							17
LC-S-0.410~~	10/24/00	2															2
LC-S-0.496	10/24/00	2								6							8
LC-Mn-3.224~~	11/3/00	1			3				5								9

Table 3.7.2. Cont'd.

Page 2 **GOOD**

	Upper Banks.....				Lower Banks.....					Bottom.....						
Site #	Landform Slope	Mass Wasting	Debris Dam Potential	Vegetative Bank Protection	Channel Capacity	Bank Rock Content	Obstructions to Flow	Cutting	Deposition	Rock Angularity	Brightness	Consolidation of Particles	Bottom Size Distribution	Scouring & Deposition	Aquatic Vegetation	Total "Good" Score
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LC-S-0.369		6	4	6			5	6								27
LC-N-0.404		7	4				5					4				20
LC-M-0.432				6	2				8	2		4				22
LC-M-0.910		7			2		4	6	10							29
LC-Mn-2.274~					2											2
LC-M-2.270~																n/a
RB-0.071		7		5	2		4	6	8							32
RB-1.434		7	4	5	2		4									22
RB-3.961			5		2		4	6	6							23
LC-M-0.533			4	6		4			8			4				26
RB-2.119	4	6	4	5	2		4	6								31
LC-Mw-2.896		6	5		2		4	6								23
LC-N-0.850~~		7	5		2		4	6	8							32
LC-M-1.640~					2											2
LC-M-1.663~				7			4									11
LC-N-0.595	4		4		2		4									14
LC-M-0.603					2				8							10
LC-M-0.020~~		6			2			6						12		26
LC-M-3.098			4				3							12		19
LC-S-0.410~~		7		6	2											15
LC-S-0.496		6	4	6	2		3	6					8	12	2	49
LC-Mn-3.224~~	4	4	4		2		3									17

Table 3.7.2. Cont'd.

Page 3 **FAIR**

	Upper Banks.....				Lower Banks.....					Bottom.....						
Site #	Landform Slope	Mass Wasting	Debris Dam Potential	Vegetative Bank Protection	Channel Capacity	Bank Rock Content	Obstructions to Flow	Cutting	Deposition	Rock Angularity	Brightness	Consolidation of Particles	Bottom Size Distribution	Scouring & Deposition	Aquatic Vegetation	Total "Fair" Score
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LC-S-0.369									11							11
LC-N-0.404								10		3	3				3	19
LC-M-0.432	6	10	6			6	6	12			3			18	3	70
LC-M-0.910			6										14	18	3	41
LC-Mn-2.274~		8	5				6	9	10							38
LC-M-2.270~																n/a
RB-0.071	6		6													12
RB-1.434								12	10							22
RB-3.961														18		18
LC-M-0.533		7						12			3		12	18	3	55
RB-2.119																0
LC-Mw-2.896															3	3
LC-N-0.850~~																0
LC-M-1.640~		8	6				5	9	10						3	41
LC-M-1.663~	7	9	6			8			12							42
LC-N-0.595	6	9						12	12							39
LC-M-0.603																0
LC-M-0.020~~			6				6								3	15
LC-M-3.098											3		14		3	20
LC-S-0.410~~								12	12		3	6	14			47
LC-S-0.496																0
LC-Mn-3.224~~									11				14		3	28

Table 3.7.2. Cont'd.

Page 4 **POOR**

	Upper Banks				Lower Banks					Bottom						
Site #	**Landform Slope**	**Mass Wasting**	**Debris Dam Potential**	**Vegetative Bank Protection**	**Channel Capacity**	**Bank Rock Content**	**Obstructions to Flow**	**Cutting**	**Deposition**	**Rock Angularity**	**Brightness**	**Consolidation of Particles**	**Bottom Size Distribution**	**Scouring & Deposition**	**Aquatic Vegetation**	**Total "Poor" Score**
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LC-S-0.369						8				4	4	8	16	24	4	68
LC-N-0.404						8			14				14	24		60
LC-M-0.432																0
LC-M-0.910						8				4	4	8				24
LC-Mn-2.274~						8				4	4	8	16	24	4	68
LC-M-2.270~																n/a
RB-0.071						8				4	4	8	16	24	4	68
RB-1.434						8				4	4	8	16	24	4	68
RB-3.961						8				4	4	8	16		4	44
LC-M-0.533	8															8
RB-2.119						8				4	4	8	16	24	4	68
LC-Mw-2.896						8				4	4	8	14	24		62
LC-N-0.850~~						8				4	4	8	14	24	4	66
LC-M-1.640~						8				4	4	8	14	24		62
LC-M-1.663~								16		4	4	8	16	24	4	76
LC-N-0.595						8				4	4	8	16	24	4	68
LC-M-0.603		12	8			8	8	16		4	4	8	16	24	4	112
LC-M-0.020~~						8				4	4	8	16			40
LC-M-3.098						8				4		8				20
LC-S-0.410~~			8			8	7			4				24	4	55
LC-S-0.496						8				4	4					16
LC-Mn-3.224~~						8				4	4	4		24	4	48

Table 3.7.2. Cont'd. Under the "stream type" column, both E5 & E6 channels were listed because pebble counts were used to estimate substrate sizes at the sites rather than sieve-series analyses of the substrates. (Due to the data collected and observations made in this study, it is assumed that the pre-human stream type in the study watersheds was either "E5" or "E6".) This resulted in only a moderate degree of confidence in differentiation between sand and silt/clay substrate particles and thus some uncertainty when assigning sites to a category of E5 vs. E6. Thus this table presents the range of stream type and reach condition assigned values. Under the "reach condition" column, a "G" indicates good, "F" indicates fair, "P" indicates poor, and "VP" indicates very poor. "VP" was a category created for this study and it included all scores of 20 pts. or more greater than the "P category. A bold value in the "reach condition" column indicates the stream type category to which that particular site was assigned for this study. A lack of a bold value indicates that the reach either was not assigned an "E" classification or it had not been classified at all (Table 3.7.1).

Site #	Pfankuch Rating (TOTAL SCORE)	Reach Condition (based upon Pfankuch as modified in Rosgen 1996)		Sediment Supply	Streambed Stability	W/D Ratio Condition	Notes
(pre-human disturbance) stream type:		E5	E6	*-- Difficult to assess in a sandy-silty system. --*			
LC-S-0.369	109	**very poor**	very poor	high	stable*	normal	import = export
LC-N-0.404	105	poor	poor	high	aggrading	normal	
LC-M-0.432	92	fair	poor	high	degrading	normal	
LC-M-0.910	100	poor	poor				
LC-Mn-2.274~	111	poor	**very poor**	high	degrading?	normal	
LC-M-2.270~	n/a						
RB-0.071	112	poor	very poor				Deposition is mostly sand, not gravel.
RB-1.434	114	**poor**	very poor				For about 30% of this reach, the stream runs alongside fill from the Turnpike connector and the banks here are steep. Here the "Landform Slope" score = 7, the "Mass Wasting" score = 9, and the "Cutting" score = 16.
RB-3.961	93	**fair**	poor				
LC-M-0.533	93	fair	poor	high	degrading*	normal	Even though this area is dominated by pools, there appears to be a lot of scour and downcutting.
RB-2.119	103	**poor**	poor				
LC-Mw-2.896	96	fair	poor				
LC-N-0.850~~	101	poor	poor	high	aggrading	normal	
LC-M-1.640~	110	**poor**	very poor	high	somewhat stable in many places; degrading in a few places	normal	This area included the area around the cross-section at LC-M-1.653.
LC-M-1.663~	131	very poor	very poor				At this location, the stream is approaching a steep wooded bank at a sharp angle, so the bank area immediately adjacent to the stream is very steep and eroding. (The tree roots in this bank are providing a lot of short-term bank stability.) Note that office & industrial parks upstream of this area may be contributing to altered hydrology and channel de-stabilization in this area.
LC-N-0.595	124	**very poor**	very poor	high	degrading	normal	
LC-M-0.603	125	very poor	very poor	high	degrading	?	
LC-M-0.020~~	88	fair	poor	high	stable	normal	
LC-M-3.098	76	fair	fair	moderate	stable	normal	
LC-S-0.410~~	119	very poor	very poor	high	aggrading in the middle; degrading on the sides	high	This site is approxmiately 300 m downstream of both stormwater detention ponds and outfalls and riprap (both on the banks and in the channel). These structures and areas may be the source of a large proportion of the gravels which were found at this site (which hence influenced the stability score).
LC-S-0.496	73	good	fair				
LC-Mn-3.224~~	102	poor	poor	low	stable	normal	

Table 4.1a. Nonpoint sources of common metal pollutants in urban watersheds. Industrial discharges can also be the source of these metal pollutants. (Sources of information: reviews in Paul and Meyer 2001 and Woodcock 2002.)

Metal Pollutant	Typical Source of Pollutant
cadmium	tires; lubricating oils; coatings on galvanized metals
chromium	brake linings; tires; engine parts (e.g., wheel bearings)
copper	brake linings; tires; engine parts
iron	corrosion product of vehicles
lead	brake linings; tires
manganese	engine parts
nickel	brake linings; tires; engine parts (e.g., wheel bearings); lubricating oils; diesel fuel
zinc	tires; lubricating fluids; galvanized auto parts; galvanized culverts

Table 4.1b. Comparison of metal concentrations in water column samples between the South Portland Engineering study (1994) and the present study. In the 1994 study, water samples were collected near where both Long Creek and Red Brook each enter into Clark's Pond. *1994 Study*: Federal standards were listed as follows: copper: 1000 ppb, lead: 50 ppb, and zinc: 5000 ppb. Low-flow (background) sampling occurred on October 5, 1992, a "pre-leaf-drop" date which had been through an eight-day period without rain. Stormwater sampling for the study occurred during an 1.79" rain storm over a 15 hr period on August 18, 1994 (8/94). Long Creek was termed "Jackson Brook" in the 1994 report (South Portland Engineering Department 1994). *Present Study*: Two sets of values are presented from the present study. The March 2000 (3/00) storm was a 1.6" storm over 29 hours and the September 2001 storm (9/01) was a 1.71" storm over 24 hours. In the "low-flow" table, the maximum concentrations measured over 3 low-flow events are presented.

Metal Pollutant	Maximum Concentration Obtained During a Storm (ppm)									
	1994 Study		Present Study							
Site:	LC-0~	RB-0~	LC-S-0.186	LC-S-0.186	LC-M-0.595	LC-M-0.595	LC-N-0.585	LC-N-0.585	RB-1.694	RB-1.964
Date:	8/94	8/94	3/00	9/01	3/00	9/01	3/00	9/01	3/00	9/01
copper	0.007	0.008	0.044	0.007	0.021	0.015	0.018	0.013	<0.002	0.003
lead	0.003	0.009	0.090	0.007	0.052	0.025	0.031	0.015	0.003	0.004
zinc	0.050	0.070	0.270	0.062	0.200	0.110	0.140	0.120	0.024	0.023

Metal Pollutant	Maximum Concentration Obtained During Low-Flow Conditions (ppm)					
	1994 Study		Present Study			
Site:	LC	RB	LC-S	LC-M	LC-N	RB
copper	0.008	0.005	0.002	<0.002	<0.002	<0.002
lead	0.005	<0.001	<0.003	<0.003	<0.003	<0.003
zinc	0.025	0.025	0.007	<0.005	0.015	0.009

Table 4.2. Comparisons between Guay's (2002) stormwater study of a "flashy" urban tributary (~40% PTIA) of Frost Gully Brook in Freeport, Maine. The storms included in this table either were his larger or most intense storm events. "FG-ut (#)" indicates Frost Gully Brook-urban tributary and the particular event sampled, while LC-S indicates sites LC-S-0.186 (PTIA = 47%) from this study. Data from Guay (2002) are samples that were collected during the "first flush" of storm event sampling, while data from Long Creek were collected during the "rise-to-peak" of the hydrograph, were maximum values observed, and considered to be fairly comparable. Specific conductivity is discussed later in this section. An asterisk (*) indicates that the value is expressed as ppm of nitrogen. ** Guay noted high turbidity during FG-t #4, apparently due to winter road sand. *** These precipitation values represent the major periods of rain during which monitoring took place and not periods of drizzle or trace precipitation.

Storm #	Storm Type	TSS (ppm)	Total-P (ppm)	TKN (ppm)	$NO_2 + NO_3$ (ppm)
FG-ut (#2)	0.70"/7 hours in November 2000	29	0.052	0.5	0.60
FG-ut (#4)	0.25"/2.5 hrs in May 2001 **	2520	2.500	6.5	0.45
FG-ut (#5)	0.90"/3 hours in September 2001	530	1.100	4.6	0.75
LC-S (#1)	1.30"/7 hours in March 2000 ***	563	0.690	1.9	0.26
LC-S (#2)	1.10"/21 hours in October 2000 ***	20	0.074	1.0	20.00
LC-S (#3)	1.6"/12 hours in September 2001 ***	70	0.100	0.6	0.31

Table 4.3. A summary of findings on temperatures observed to be detrimental to brook trout as reported in a literature review written by McCullough (1999). Please refer to his document for more complete information. Part I details information about field observations while Part II details information about laboratory experiments.

I. *Field Observations*

Upper Limit of Temperatures Where Brook Trout Were Observed(°C)	Comments
a) 22	a) Upper limit (3-week mean temperature) for self-sustaining populations in southern Ontario streams (Barton et al. 1985).
b) 25.6	b) Upper limit (instantaneous observed temperature) for self-sustaining populations in southern Ontario streams (Barton et al. 1985).
c) 22-24	c) Various Ontario streams (Meisner 1990; also see review in Meisner 1990)
d) 19-20	d) Various Virginia streams (Burton and Odum).
e) 22.3	e) A study analyzed a large national database of brook trout presence/absence data and weekly mean temperatures. The authors eliminated the upper-end 5% of temperatures where brook were found to be present to get a more conservative estimate of an upper thermal tolerance limit. After eliminating the upper-end 5%, they found the 95%-ile thermal tolerance temperature to be 22.3 °C (Eaton et al. 1995).
f) 19-20	f) Self-sustaining populations of brook trout tend to be limited to stream zones with temperatures < 19-20 °C (review in Hokanson et al. 1973).

II. *Laboratory Experiments*

Brook Trout Life Stage	Important Temperatures (°C)	Comments
Egg / Alevin	a) > 16	a) When pre-spawning brook trout adults were held in 16 °C water, the percentage of normal egg hatching was 0%. As test temperatures were lowered, percent-hatching increased. At 6-8 °C, percent hatching was > 90% (Hokanson et al. 1973).
	b) > 15 > 9	b) When eggs were held at 1.5 - 9.0 °C, percent survival to hatching was 80-85%. Percent survival to hatching was 0% at 15 °C. (Hokanson et al. 1973, Humpesch 1985).
	c) ≥ 18	c) Considered detrimental to newly hatched alevins (McCormick et al. 1972).
Juvenile	d) 24[a] - 25.5[b]	d) Range of upper incipient lethal temperatures (UILT) determined by [a]Cherry et al. (1977) and [b]Fry et al. (1946). [UILT = a temperature, given a previous acclimation to a constant temperature, that 50% of the fish can tolerate for 7 days. The acclimation temperature for "[b]" was 24 °C, while it was not reported for "[a]".]
Adult	e) 16-19	e) For spawning female brook trout (Hokanson et al. 1973).
	f) 19	f) For spawning male brook trout (Hokanson et al. 1973).
	g) 9	g) Optimal conditions for spawning brook trout (Hokanson et al. 1973).